SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS

RTP

2008

REGIONAL TRANSPORTATION PLAN

*Making the Connections*

# *Travel Demand Management Report*

**DRAFT**

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# TDM

# Evaluating the Potential of Travel Demand Management (TDM) to Affect Traffic Congestion in the SCAG Region:

## What Does the Research Tell Us?

Travel demand management (TDM) and the related transportation systems management (TSM) rose to prominence in the 1970s and 1980s as cost-effective alternatives to road capacity expansions. TDM strategies are of two kinds: voluntary, or "soft," strategies – like preferential parking for carpoolers – that aim to lure some to alter their travel behavior in response to voluntary inducements, and "hard" strategies – like congestion pricing – that shift the behavior of a large number of travelers by changing the price of travel. TDM also can include regulatory strategies, such as regional employer ridesharing mandates. Among these approaches, this memorandum focuses on the potential of soft TDM strategies to affect travel behavior and, in turn, levels of traffic congestion.

The Los Angeles area has been home to some of the more innovative and successful TDM efforts over the years. Careful evaluations of these efforts, and others around the U.S., have shown that soft TDM strategies can be very effective in reducing single-occupant vehicle travel at the scale of an intersection or large employment site, but that the staying power of soft TDM strategies often fades over time. These effects contrast with hard TDM strategies, like road and parking pricing, which have been shown to influence travel behavior more durably and, depending on the application, over much larger geographies. It is therefore unlikely that soft TDM strategies – like rideshare matching or vanpool subsidies – will significantly affect traffic levels at a regional scale, no matter how aggressively they are implemented. This does not mean that such programs are not worth pursuing or that they cannot have locally significant effects in dozens, or even hundreds, of locations if implemented regionally, but rather that potential effects on regional traffic congestion should not be overstated.

It is important to note, however, that soft TDM programs may bring substantial regional benefits, if not widespread congestion relief. Effective TDM programs can increase choices for travelers, and reduce per capita non-renewable energy consumption and emissions. When transit use, carpooling, biking, and walking rise, transportation system efficiency tends to increase, bringing many benefits to the region. Thus, these benefits can justify substantial public expenditures on effectively implemented soft TDM programs, even absent regional congestion benefits.

This chapter outlines the TDM strategies that the SCAG region has committed to investing in the 2008 Regional Transportation Plan (RTP). It also examines TDM strategies and their effects on traffic first by defining terms and concepts; second by examining the lessons learned from the evolution of TDM promotion; third by fleshing out the travel behavior logic that underlies (and often foils) TDM strategies; fourth by reviewing the evaluation literature on non-pricing-based TDM strategies; and finally by presenting research-based conclusions regarding the potential of TDM strategies to affect travel and congestion.

## TDM Strategies in the 2008 RTP

The potential effectiveness of TDM now and in the future depends largely on social and institutional commitments that cause individual travelers to choose a mode of travel other than solo driving, as well as funding for marketing and incentives that change travel behavior. If we were to do nothing beyond our current efforts, the region would not likely sustain the current levels of ridesharing, non-motorized and telework/telecommute/work-at-home, let alone expand them over the 2008 RTP period. Given their potential to cost-effectively reduce vehicle trips, regional leaders recognized the importance of TDM by providing significant funding for TDM strategies.

The "soft" strategies identified in the 2008 RTP include increasing ridesharing, work-at home, and non-motorized transportation. For rideshare, telecommute, and park-n-ride activities, the RTP provides investments of over

$2.2 billion through 2035. The RTP also allocates over $2.6 billion for non-motorized transportation. As important as these investments are, however, more substantial and sustained reactions in congestion in the years ahead will require “hard” strategies, especially parking and congestion pricing. Precisely because the travel behavior effects are so significant, hard strategies can be controversial and require significant analysis, consensus building, and public education prior to implementation. However, pricing benefits have proven to be more sustainable over time and complement the integrated land use strategies adopted by the region.

## INCREASING RIDESHARE (CARPOOL AND VAN POOL)

The SCAG region continues to invest heavily in High Occupancy Vehicle (HOV) infrastructure that provides incentives for commuters to share rides with others. While the absolute number of HOVs is growing over time, the share of total travelers using car- and van-pools is not. Accordingly, SCAG and its partners will strengthen their efforts to encourage ridesharing and other trip reducing strategies that aim to reduce vehicle trips, energy consumption, and air emissions. These efforts will include:

- Program public funds in the RTIP to help maintain the public sector share of the existing rideshare market and to increase the number of carpools.
- Provide “seamless” intra- and inter-county carpool services to the regional traveler.
- Formalize and expand partnerships among public and private sector stakeholders to improve delivery of vanpool services regionally.
- Increase the number of commuter vanpools through more effective marketing and the provision of non-monetary public sector incentives.
- Establish a dedicated funding source for planning and implementing vanpool programs and services.
- Expand the provision of vanpool services in the Region through an increase in dedicated public-sector staffing and resources.
- Facilitate a regionally coordinated marketing strategy among the public and private sectors to enhance vanpool programs, increase ridership and improve outreach efforts.

## INCREASING WORK-AT-HOME (TELEWORK/TELECOMMUTE AND HOME-BASED BUSINESS)

Increasing the number of workers who work-at-home (self-employed, home-based business owners) or who telework/telecommute (wage and salary employees conducting some or all of their work from home) decreases homebased work trips, vehicle-miles of travel, congestion and vehicle emissions. National and regional surveys of those who telecommute indicate that it is a lack of support and trust from “management,” rather than the provision of equipment or the desire of workers to telecommute, that hampers the growth of telecommuting. Therefore, the 2008 RTP recommends the following actions:

- Formalize and expand partnerships among public and private sector stakeholders to increase opportunities for wage and salary workers regionally to telecommute in-lieu of daily commuting.
- Promote telecommuting to increase opportunities for wage and salary workers regionally to telecommute in-lieu of daily commuting.

## NON-MOTORIZED TRANSPORTATION

Commuter trips within the region average a self-reported distance to work of 19.2 miles, too far for most bicyclists and all pedestrians. However, the integration of bicycle and transit nodes offers the opportunity to extend the commuting range of bicyclists. There are many ways that bicycling and walking are important beyond work trips. According to the 2001 National Household Travel Survey, 50 percent of all urban trips were less than 3 miles, and 28 percent of all trips were less than 1 mile. These trips are ideal for biking, walking and transit or a combination of those modes of travel.

Bicycle transportation infrastructure has a role in regional mobility and air quality improvements. Every single percent of automobile drivers that switch to alternative transportation choice (walking, bicycles, transit) reduces air pollution, congestion, the need for increasing roadway capacity and, in the case of walking and bicycling, improves public health.

Bicycle and pedestrian improvements are today included as part of many larger street maintenance and construction projects. These investments and supporting policies aim to maximize the benefits of this efficient mode of transportation. Specifically, the RTP provides for the following:

1. Decrease bicyclists and pedestrians fatalities and injuries in the state to 25% below 2000 levels. Ways to address non-motorized safety were discussed under Transportation Safety.
2. Increase accommodation and planning for bicyclists and pedestrians: The needs of non-motorized travel (including pedestrian, bicyclists and persons with disabilities) need to be fully considered for all transportation planning projects.
3. Increase bicycle and pedestrian use in the SCAG region as an alternative to utilitarian vehicle trips: Create and maintain an atmosphere conducive to non-motorized transportation, including well maintained bicycle and pedestrian facilities, easy access to transit facilities, and increasing safety and security. While pedestrian sidewalks are fairly well established in most areas, it is estimated that there are only 3,218 miles of dedicated bicycle facilities in the region, with an additional 3,170 miles planned.
4. Increase non-motorized transportation data: To make non-motorized modes an integral part of the region's intermodal transportation planning process and system, reliable data for planning are needed. Nonmotorized transportation data needs include, but are not limited to comprehensive user statistics; user demographics; bicycle travel patterns/corridors; accident mapping; bikeway system characteristics; and sub regional improvements projects and funding needs.
5. Encourage Development of local Non-Motorized Plans: Encourage all counties and cities within the SCAG region to develop non-motorized plans and policies for their jurisdiction. Also, non-motorized plans that have been created or updated within the previous five years are eligible for bicycle transportation account (BTA) funds.
6. Develop a Regional Non-motorized plan: SCAG will work with all countiesand their cities to coordinate and integrate all non-motorized plans from counties and jurisdictions in the SCAG region in a collaborative process, including interested stakeholders.

## Defining Terms, Organizing Concepts

The terms travel demand management (TDM) and transportation systems management (TSM) are often employed loosely, and sometimes interchangeably, in practice. In a nutshell, they can be defined as follows:

Transportation Systems Management:

> Supply-side approaches to cost-effectively increase system performance – short of costly capacity additions. Examples include coordinated signal timing, freeway ramp metering, and high-occupancy vehicle lanes

Transportation Demand Management:

> Demand-side approaches to cost-effectively increase system performance – short of travel prohibitions. Examples include commute[1] rideshare matching, and employer flex-time programs, and high-occupancy/toll (HOT) lanes.

That high-occupancy vehicle (HOV) lanes can be considered both TSM and TDM speaks to the difficulty of clearly and definitively defining these terms. HOV lanes are TSM when they shift multiple-occupant vehicles into congestion-free lanes thereby increasing the throughput of people and reducing the average level of delay per traveler (if not per vehicle). HOV lanes are also TDM to the extent that they motivate people who would not otherwise form carpools to do so in order to enjoy travel time savings.

[1] Commute trips, in transportation planning parlance, refers to journeys between home and work, but not to trips made during the course of work.

Additionally, the provision of transit services (either in the form of increased capacity through more frequent service, or in the form of amenities to improve comfort for riders), can be considered both TSM – in the sense that increased transit capacity can produce overall increases to the transportation system – and TDM – in the sense that improved transit, depending on its implementation, can attract riders from single occupancy vehicles. Thus, while this Report focuses on TDM, some TDM/TSM strategies are discussed as well.

Eric Ferguson (1995) developed a useful way to think about the application of TDM strategies to transportation policy and planning by linking them to the four steps in the traditional travel demand modeling process.

Trip Generation

- Goal: Eliminate trips entirely
- Examples: Telecommuting, web-based retail

Trip Distribution

- Goal: Shift trips from more congested destinations to less congested ones
- Examples: On-site daycare, satellite offices

Mode Choice

- Goal: Shift trips from lower-occupancy modes to higher-occupancy ones
- Examples: Parking pricing, carpool/vanpool programs, transit pass programs, guaranteed ride home programs

Route Selection (spatial)

- Goal: Shift trips from more congested routes to less congested ones
- Examples: Traffic calming, vehicle navigation systems

Route Selection (temporal)

- Goal: Shift trips from more congested time periods to less congested ones
- Examples: Mixed-use development, alternative work schedules

Ferguson's stratification by the four-step modeling process provides a useful conceptual model for evaluating TDM effects on travel behavior. However, mapping how these changes in travel behavior then translate into traffic (or congestion) reduction is a more difficult endeavor. Congestion is defined relative to free-flow traffic conditions, and occurs when there are more vehicles in the network than the supply of roads can handle. The result is lower vehicular throughput and increased traveler time delays. Congestion can occur at street intersections or freeway ramps, grow out of activity sites, back up onto arterial segments, stretch along corridors, spill over into neighborhoods, and seep across networks and regions.

While traffic congestion is familiar to any urban resident, clearly defining and measuring the phenomenon is a surprisingly difficult challenge. In addition, congestion is a non-linear phenomenon, meaning that small changes in underlying causes (vehicle demand, capacity, incidents, weather, etc.) can sometimes cause large changes – increases or reductions – in delay. Given such complexities, it is perhaps not surprising that most studies evaluating TDM efforts measure changes in travel behavior (and in particular commute mode) instead. Travel behaviors are more easily measured through traveler surveys or traffic counts, and typically include measures such before-and-after modal shares to particular sites, reductions in vehicle trips at sites, or estimated changes in vehicle miles traveled. While such metrics are inputs to congestion outcomes, the cause and effect relationship is far from direct. There thus exists in the TDM research literature a significant gap between our understanding of programmatic inputs and congestion outputs that is explored in more detail below.

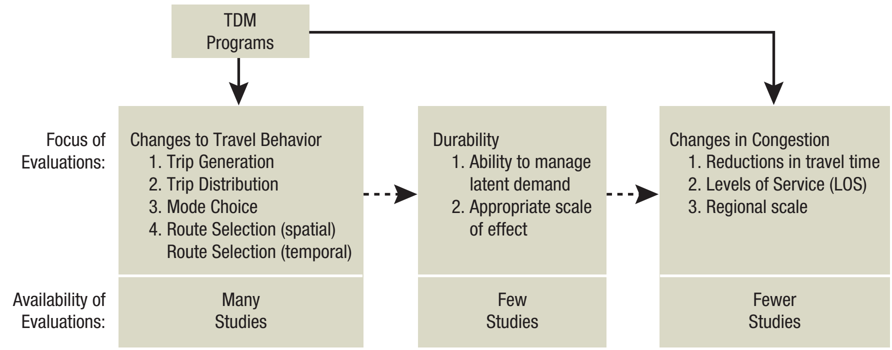
The conceptual link between travel behavior and traffic congestion is key to understanding why TDM efforts – especially soft, voluntary strategies – are unlikely to affect regional congestion levels (see Figure 1). As we will see below, TDM programs have been shown to change individual travel behaviors to some degree, but regional effects on traffic congestion levels requires that two additional conditions be met:

Scale Congruence: The spatial scale of the TDM strategy must be congruent with the geographic scale of the congestion problem. For example, local traffic delays at a large work site may be mitigated by a TDM program that shifts employees away from solo commuting and into alternative travel modes. But geographic focus of the TDM program and the relatively small share of regional vehicle trips mean that regional congestion levels are unlikely to be affected.

Policy/program durability: The TDM strategy must be durable. Questions of scale and geography notwithstanding, soft TDM strategies can motivate changes in travel behavior by offering incentives to travelers to change modes, travel at different times of the day, use different routes, or forgo trips altogether. When such strategies are effectively implemented, competing claims for road space are reduced and vehicle delays lessen, at least at a local level. But motivations are ephemeral. Program participation often fades; drivers revert to old habits, and ambient growth combine to fill in the capacity that was previously freed up by the TDM program. This phenomenon – known as "triple convergence" – reflects the so-called latent demand for travel. As will be explained further, soft TDM strategies are less effective than hard TDM strategies at managing latent demand, which explains why TDM policy/program-motivated changes to travel behavior often do not translate into congestion relief.

Figure 1 synthesizes the TDM evaluation literature in a behavioral framework linking TDM programs to congestion relief. The figure shows that most studies focus on changes in individual travel behavior, and do not address issues of scale congruence and policy/program durability.

**FIGURE 1 TDM PROGRAMS AND EFFECTS ON TRAVEL BEHAVIOR AND CONGESTION**




## The Evolution of TDM and Lessons Learned

The first organized TDM efforts in the U.S. began during the Second World War. Facing severe fuel and rubber shortages and pressing needs to get large numbers of civilian workers to war-related jobs, the federal government initiated strict limitations on new car and tire production and fuel sales in order to conserve fuel and other industrial inputs. In addition, the federal government and most states began to promote carpooling as a patriotic contribution to the war effort (Ferguson 1997). In these early years, it became clear that the work site was a focused and effective spatial scale at which to organize many TDM programs. For example, the war department required all defense contractors to implement ridesharing programs at production sites.

Following the war, TDM was put on the back burner as California and the U.S. embarked on extraordinarily ambitious highway construction programs. During the late 1950s and early 1960s when freeway capacity was increasing faster than vehicle travel, transportation professionals did not deem using TSM or TDM to fine tune transportation system performance important. By the early 1970s, however, skyrocketing road construction costs, political backlash to the displacement and disruption of metropolitan freeway construction, and relatively slow growth in transportation revenues combined to radically curtail metropolitan freeway development.

## 1970S CRISES AND THE RISE OF MODERN TDM

It was amidst the fuel shortages of the mid- and late-1970s that TDM (and TSM) began to be widely promoted as cost-effective ways to increase the effective capacity of the road system without actually building many new roads. In 1974, the Emergency Highway Energy Conservation Act became law. The act provided 90 percent federal matching funds to support the creation of TDM agencies like Commuter Computer in Los Angeles. These agencies, initially, performed computer ride-matching to help commuters form carpools. Ferguson (1999) traces the evolution of TDM as a "natural outgrowth" of TSM and suggests that voluntary TDM strategies – generally low in cost and politically innocuous, such as the provision of information about alternative travel modes – are direct descendents of TSM tradition in that they increased effective capacity, filled excess capacity (in the form of empty passenger seats in automobiles, for example), and provided alternative options on the transportation network as a whole.

Unfortunately, most TDM efforts in 1970s had disappointingly little success. People in general, and women in particular, were reluctant to enter ridesharing arrangements with strangers, so relatively few people availed themselves of computer ride-matching services. Information about potential carpooling partners, in other words, turned out not to be the, or even a, principal impediment to ridesharing. As such, regional ridesharing agencies evolved over time into full-service transportation alternatives agencies that assist individuals and, importantly, large employers with alternatives to solo commuting.

In a nutshell, evaluations of TDM programs in the last quarter of the 20th Century found that most carpoolers are family members (Teal 1987), and those who voluntarily enter ridesharing arrangements usually have some connection – most often a common employer – with the other person. As a result, the most successful TDM programs have been at large employment sites.

## CASUAL CARPOOLING

Outside of large employment sites, however, some ridesharing arrangements have grown in popularity along corridors or facilities with HOV lanes or tolls. Metropolitan regions in the U.S. such as the San Francisco Bay Area; Washington, DC; and Houston have seen growth in what is known as "casual carpooling." These are informal, loosely coordinated, and largely self-regulating systems of travelers who save time by qualifying to travel in HOV lanes, to bypass toll lines, and/or save money by sharing tolls. Generally, solo drivers pick up passengers at informal designated waiting areas, and deliver them to agreed-upon drop-off points. Because casual carpooling most often arises around traffic bottlenecks like bridges, tunnels, and passes where significant HOV time savings attract many participants, they have the potential to meaningfully affect traffic congestion at a regional scale. Unfortunately, most research on casual carpooling has focused on the spontaneous development of ridesharing systems in response to significant time savings for ridesharers (Burris and Winn 2006, Beroldo 1990), and not on the effects of these systems on regional-scale traffic flows.

## THE 1984 SUMMER OLYMPICS IN LOS ANGELES

In contrast to casual carpooling, formally organized soft TDM programs typically rely on marketing and inducements to motivate participation. As a result, their effectiveness tends to fade over time. Focused, short-term efforts, on the other hand, can produce impressive results. There is perhaps no more dramatic example of this than the 1984 Summer Olympic Games in Los Angeles. Fears of gridlock and smog alerts caused Olympics organizers to work with city, regional, and state transportation officials to mount a comprehensive and extraordinarily effective TSM and TDM effort to mitigate the traffic generated by millions of spectators on the already congested street and freeway systems in LA.

It was a very big effort. An extensive park and ride bus system was developed to deliver people to the dozens of venues spread around southern California. Traffic signals around major venues (such as Exposition Park) were synchronized and comprehensive timing schemas delivered traffic to the site before the event, and away after. This effort initiated the by now well known Automated Traffic Surveillance and Control (ATSAC) system in Los Angeles. This comprehensive, synchronized timing program has gradually been expanded over the years into an elaborate, and dynamic, system of traffic signal timing and synchronization. Other Olympic TDM efforts included the hundreds of employers who promoted carpooling programs to their workers. Some downtown offices even shifted normal business hours during the games from 8:00 am to 5:00 pm, to 2:00 pm to 10:00 pm so that all employees would be commuting outside of normal peak hours.

The results of all of these efforts were dramatic. Despite hundreds of thousands of additional trips being loaded onto southern California's street and highway systems, congestion declined significantly and traffic flowed more smoothly than it had in years. But these dramatic results were short-lived. Traffic delays gradually increased during the games and quickly returned to pre-games levels by the closing ceremony (Giuliano,1988).

Giuliano et al (1986) evaluated the institutional arrangements, operational changes, program implementation, and effects on traffic congestion of TDM/TSM measures to test whether their effectiveness under extreme conditions (like during the Olympics) could be extended to managing general, recurrent congestion. The authors found that efforts that changed travel behavior among LA residents (like flex work schedules, telecommuting options, and ridesharing promotion) had more immediate effect on traffic conditions than changes to the transportation system (such as one-way streets, ramp metering, synchronized traffic signals, and increased levels of transit). But these behavioral changes were short-lived (and short-intentioned). For example, a survey of employees at four downtown Los Angeles work sites showed that many residents used vacation time, modified their work weeks, worked from home, or postponed shopping, medical visits, and business-related trips during the Olympics (Giuliano, et al 1986).

## CATEGORIZING TDM POLICES AND THEIR EFFECTS TODAY

The lesson of the 1984 Summer Olympics in Los Angeles is an important one for TDM planners today. Appealing to people to act against their own best interests can work well during unusual events, and even then for only short periods. In other words, there is a difference between carrots (soft TDM) and sticks (hard TDM) – carrots wilt, but sticks don't. Another way of conceptualizing who is affected by TDM programs and how was developed by Bond and Steiner (2006), who employ a conceptual categorization of TDM strategies borrowed from Litman (1999):

1. <u>Expands options for all</u>: Unlimited access transit, transit service improvements, pedestrian/bicycle capital improvements;
2. <u>Expands options for some</u>: carpooling program, park-and-ride facilities, traffic calming; and
3. <u>Reduces options for all</u>: parking pricing, parking restrictions, auto-free zones, and transportation fees.

Expanding options tend to be more politically popular than reducing them, and policies and programs that affect all travelers are more broadly effective in reducing vehicle trips than those that influence only some people.

Today, TDM is often promoted as an air quality strategy. Under the recent Clean Air Act amendments and the Congestion Management and Air Quality (CMAQ) program, the most common model of TDM promotion has been one of delegated responsibility. The federal government pushes states/regions; the states/regions push employers; and employers coax, cajole, and encourage employees not to drive alone. Collectively, evaluations of the TDM efforts, many of which are summarized below, find that:

- Encouraging alternates to driving alone has very limited influence on travel behavior, but is popular with nearly everyone;
- Using road and parking pricing to motivate changes in travel behavior is very effective and, because of this, is far less popular politically; and

- Forcing people out of driving alone through prohibitions like odd/even license plate driving restrictions encourages cheating and is wildly unpopular with nearly everyone.

### LESSONS LEARNED FROM THE EVOLUTION OF TDM

1. While few evaluations have explicitly examined whether TDM programs have affected congestion levels, this short history of TDM policies suggest that soft TDM programs are unlikely to influence congestion at a regional scale. Most studies have evaluated the effect of TDM programs on travel behavior, due at least in part to the difficulty in actually measuring changes in congestion.
2. TDM policies have not always focused on congestion. In the early years, for example, TDM policies were used to manage fuel and rubber shortages. And in later years, soft TDM has often been promoted as a cheap way to increase transportation system efficiency – vehicle flows, energy consumption, air quality, etc. – broadly.
3. Over the past decade hard TDM policies have been afforded front-burner attention because of chronic transportation revenue shortages. The waxing interest in roadway pricing is often motivated more by a search for a politically palatable revenue source, than in any interest in using prices to manage travel demand (Sorensen and Taylor, 2005).

## Understanding the Logic of TDM: What's Possible, What Isn't?

Soft TDM programs – that is those that do not involve pricing roadways or parking – can increase the effective capacity of transportation systems, but are unlikely to reduce congestion at any spatial scale greater than the job site or intersection. In instances where they do, the effectiveness of soft TDM programs tends to diminish over time. Why? They diminish over time because of latent (or induced) demand.

Consider the example of HOV lanes. If properly implemented, HOV lanes offer carpoolers significant time savings over solo drivers. If these times savings are both substantial and consistent, they can motivate some former solo drivers to form carpools in order to use the faster HOV lanes. If enough solo drivers do this and if the HOV lanes remain uncongested, congestion in the "free" lanes may be reduced, resulting in time savings and energy and emissions reductions for all roadway users.

### THE LATENT DEMAND PARADOX: WHY TDM PROGRAMS ARE UNLIKELY TO MEANINGFULLY AFFECT REGIONAL CONGESTION

Unfortunately, such benefits tend to quickly erode. First, delay reductions in the formerly congested free lanes will attract trips by travelers who had been dissuaded by congestion from using the roadway. These new trips can shift from other, less congested times, other, less congested routes, and/or other modes in a process Anthony Downs has termed "triple convergence" (Downs, 2004). Second, the lower delay costs on newly uncongested roadway will encourage some people to make entirely new trips. And, third reduced delay in the free lanes will reduce or eliminate the relative HOV lane time savings, causing some travelers to abandon their carpools and return to solo driving. The convergence of all of these trips onto the newly uncongested roadway thus quickly erodes congestion reductions.

Does the fact that HOV lanes are unlikely to reduce congestion over the long term mean that they don't work? Not at all, though it depends on how one defines the objectives of HOV lanes. Properly implemented and managed, HOV lanes can produce significant benefits, if not congestion reductions.[2] These benefits occur mostly through increasing the effective capacity of the roadway system. First, while vehicle delays in the free lanes may not be reduced, average levels of "person delay" can be lowered by speeding multiple-occupant vehicles on their way. Second, when travelers converge onto a for-

[2] Though research has shown that optimally managing HOV lanes is no small task, and that HOV lanes are often either underutilized or oversubscribed. Some research suggests that a substantial majority of traffic delay benefits of HOV lanes are due simply to adding road capacity and not to their effect on ridesharing behavior (Dahlgren 1995; Kim 2000).

merly congested roadways from other times, other routes, other modes, or even as entirely new trips, such travelers are by definition better off. Planners focused on mitigating congestion can sometimes miss this important point. When people can make trips at their preferred times, on their preferred routes, and on their preferred modes, benefits result. These benefits may be extra time with family for a commuter, an extra delivery each day for a firm, or a trip made in the safety, comfort, and privacy of one's motor vehicle rather than on public transit.

While HOV lanes have been used here as an example, it's important to understand that the effect of latent/induced demand in returning congestion delays to temporarily freer-flowing roadways is not confined to HOV lanes or to soft TDM strategies. The same process occurs when additional lane capacity is added to a congested roadway or even when parallel transit improvements manage to attract significant numbers of former drivers off of the road. In all cases delay on the formerly congested road is reduced in the short term, which lowers the generalized "price" of travel thereby making travel on the roadway "cheaper" (from the traveler's perspective) than before, which attracts trips back to the roadway until the "price" of travel (comprised of time costs, monetary costs, and risk/uncertainty costs) increases to a level that brings the roadway back into a congested equilibrium. In other words, the congestion time costs on roads in a densely settled metropolitan area like Los Angeles increase until travelers begin to shift to other travel times, other routes, other modes, or simply forego trips altogether – in what might be termed a "quadruple divergence," to paraphrase Downs.

This concept of congestion increasing the time costs of motor vehicle travel in densely settled areas is crucial. It explains why so many congestion reduction efforts – road capacity expansions, transit capacity expansions, traffic operations improvements, and soft TDM strategies – that reduce travel time costs in the short-term have all failed to meaningfully reduce congestion in metropolitan areas like Los Angeles over the longer term. Put simply, when any one of these strategies reduces delay in the short term, they lower the time cost of travel, and encourage more vehicle trips until delay returns to a level that discourages additional trips.

This capacity/congestion paradox is why so many transportation analysts are so enamored of road and parking pricing, despite its enduring unpopularity among the motoring public and the people whom they elect. With congestion pricing, one cost – time spent in traffic – is exchanged for another – a road and/or parking toll. While the effects of spending time or spending money on travel are surprisingly similar and interchangeable, there is a very big difference between them. When travelers spend time stuck in traffic, no one gets any revenue – it is what economists term a "dead weight loss." But when time spent in traffic is exchanged for a toll, significant revenue is produced, revenue that can be used to increase road capacity, improve public transit service, provide discounts for low-income travelers, or even to compensate people living near major transportation facilities for the noise and pollution costs they endure. This revenue presents significant opportunities to increase the efficiency, effectiveness, and equity of metropolitan transportation systems, and helps to explain why hard TDM strategies hold such promise.

But the many operational advantages and political liabilities of hard TDM strategies like pricing are not the focus on this Report. The focus here is on the more limited benefits possible from soft TDM strategies. Given the travel behavior framework described here, a variety of soft TDM strategies and programs are reviewed below with the following questions in mind:

1. What are the likely short-term effects on traffic?
2. What proportion of trips is affected?
3. At what geographic scales are these effects likely to occur?
4. How does the strategy change the "price" perceived by the traveler?
5. What are the likely long-term effects of the strategy on the time/monetary "price" of travel? Are the anticipated benefits likely to erode?

With these questions in mind, we turn now to a brief summary of the TDM evaluation literature.

## EVALUATING "SOFT" TDM STRATEGIES: WHAT HAS THE RESEARCH SHOWN?

This section synthesizes and summarizes the findings of research on soft (i.e. non-pricing- and non-regulatory-based) TDM programs around the U.S. (and, to a limited extent, internationally). Given that most studies evaluate changes in travel behavior and fewer evaluate changes to congestion levels on the transportation network, the bulk of this review will synthesize research findings on the (1) cost-effectiveness of soft TDM programs, (2) spatial scale of implementation, and (3) spatial scale of effects – in terms of travel behavior. Where studies have actually examined effects on congestion, they are summarized similarly.

In a nutshell, most TDM program evaluations are descriptive, suffer from many methodological problems, and therefore likely exaggerate the effects of TDM,

1. Ambient effects, such as changes in employment levels and fuel prices, explain far more of the variation in travel behavior and traffic flows than do TDM programs,
2. Few reliable cost-benefit evaluations of TDM programs have been conducted, and
3. Where significant effects have been measured in evaluations, they are usually from large work-site programs administered by an employer with a strong motivation to reduce local vehicle trips.

Collectively, such findings pose a significant challenge to TDM planners – the lack of rigor in most previous TDM evaluations makes it difficult to project the effects of future programs on traffic levels. This review of the TDM literature focuses on evaluations of the effect of TDM programs on travel and traffic, and not on the many descriptive summaries of such program replete in the literature. Sources for this review include peer-reviewed academic journals as well as industry/trade reviews, planning and government documents, and books.

## CAREFUL, RELIABLE TDM PROGRAM EVALUATIONS ARE DIFFICULT TO DO – AND RARE

TDM programs are difficult to evaluate because they are diverse in scope, they influence only a small part of the travel decision matrices of individuals, households, and firms, and because travel behavior choices and patterns are inherently complex and difficult to analyze (FHWA 2004). Additionally, most TDM evaluations focus on trip reduction outcomes rather than TDM effects on congestion reduction.

Why have so few TDM evaluations considered their effects on greater-than-site-level traffic levels? First, because TDM policies are programs often touted as low-cost alternatives to transportation capacity enhancements, the resources devoted to evaluating and modeling TDM policies and programs are often correspondingly small. Second, marketing the benefits of alternatives to solo driving are often central features of TDM programs, so it should come as no surprise that many ostensible analyses of TDM programs and their benefits are more promotional than evaluative in nature.

Even among the more evenhanded evaluations, methodological problems are common; they include the following:

1. Overly narrow in scope: Many of the evaluations construct statistical models of TDM program attributes on some travel behavior outcome. They typically do not compare the effectiveness of TDM programs relative to other, non-TDM programs in influencing travel behavior or reducing congestion.
2. Inadequate controls: Few of the TDM evaluations systematically control for other, non-TDM factors – such as changes in fuel prices, regional employment fluctuations, and/or demographic changes – influence outcomes. While some studies evaluate TDM programs by measuring travel behavior before and after their introduction, most do not. Thus, many studies, especially those conducted by industry/trade organizations, likely overestimate the potential of TDM programs to affect traffic levels.

3. Short-term focus: Very few studies have attempted to measure effects over time. This is a significant problem, given that the few longer-term studies have tended to find the effectiveness of TDM waning over time. Further, we know from Down's law of "triple convergence" that unless the externalities of driving (i.e. congestion and all the problems associated with it) are fully internalized, any short-term reduction in traffic delays (through soft TDM or any other means) will likely diminish over time.[3]

Collectively, these methodological limitations mean that analyses on travel behavior can be problematic, and extending the analyses further to implications for congestion reduction can be even more challenging. This makes it difficult for SCAG to draw on past research and reliably predict the travel effects of TDM strategies with confidence.

## COMPREHENSIVE TDM POLICY/PROGRAM EVALUATIONS

Bond and Steiner (2006) evaluated the University of Florida's TDM program, which included a suite of policies to reduce automobile use in favor of more sustainable modes. The campus TDM strategies included parking restrictions, parking pricing, transit service improvements, and an unlimited-access transit pass program. Individual TDM strategies were found to have modest effects on the transportation system as a whole, but multiple strategies working in concert were observed to have more substantial effects. Further, multiple strategies increase choice and thus user satisfaction by minimizing the inconvenience to individual users (Litman 1999, Bond and Steiner 2006). Conversely, some combinations of TDM strategies may work against each other. For example, flexible work schedules may reduce the utilization of vanpools and carpools, which typically require coordinated work schedules.

[3] Many early TDM evaluations noted the need to track the effects of TDM over time, through time-series analysis and other techniques (Beroldo 1990). At the time, however, most TDM programs were in their infancy. As TDM programs have matured, however, time-series studies have remained the exception, rather than the rule. Instead, more recent TDM analyses have tended to focus on statistical modeling of the relative influence of various factors (TDM program attributes, land use patterns, fuel prices, worker demographics, etc.) on mode choice.

Bond and Steiner (2006) found that the most effective policies from the University of Florida's TDM strategies either expand or reduce options for all. While TDM strategies employed at the University of Florida appear to have an ongoing effect on student, staff, and faculty travel choices, the effects on regional traffic levels are less certain. The TDM program effects appear to be enduring because both soft and hard TDM policies have been employed in concert in an effort to both push solo drivers out of single occupancy vehicles (SOVs), and pull them to travel by transit, carpools, and bicycles.

The recent Transit Cooperative Research Program study (TCRP 2005) analyzes data from three U.S. regions: Los Angeles, Tucson, and urban areas in the state of Washington. For each area the authors conducted multivariate regression analyses of the influence of program features (e.g. financial incentives) on number of vehicle commute trips to and from a given employment site. The authors found that transportation allowances, transit subsidies, vanpool subsidies, parking management, guaranteed rides home, and compressed work weeks were all associated with reduced solo-driving commute trips after implementation. Somewhat surprisingly, worksite size (number of employees) was negatively correlated with vehicle trip reduction (TCRP 2005).

Higgins (1996) evaluated several dozen studies of employer-based demand management efforts. Most studies were found to measure changes in solo driving or vehicle trip generation rates at work sites before and after the implementation of employer-based programs, but almost always without a comparison to changes at control or comparison sites. The use of a control site is, of course, important in ruling out the possibility that some other unrelated event influenced driving rates (e.g. fuel prices, change in parking rates, local economic fluctuations, seasonal weather events, etc.). Other studies examined compared solo driving rates among program participants with the driving rates typical in the surrounding area or region.

Higgins then developed a classical experimental design and tested for changes in travel behavior at 40 work sites in the Denver region, based on pilot TDM and control programs. Given the rigor of this particular study, the results are especially discouraging: Higgins found no statistically significant difference in solo driving rates between test (TDM) and control (no TDM) sites, though he did find a very small, but statistically significant, increase in walking at the test sites.

## RIDESHARING POLICY/ PROGRAM EVALUATIONS

There is an abundance of ridesharing program evaluations, probably due to the multitude of local, regional, and state efforts around the U.S. Sometimes mandated and sometimes voluntary, most of these programs, and evaluations of them, center on large employment sites. In the aggregate, however, the ridesharing picture is not encouraging.

Pisarski (2004) finds that carpooling has declined over the past decade, and now stands at approximately 12 percent of all commutes nationally. While there are no reliable data on the number of ridesharing arrangements motivated by formal programs and incentives like HOV lanes, the relatively small share of employers with TDM programs and the proportion of road networks with HOV lanes suggest that the vast majority of carpoolers choose to do so without any formal inducement.

Dill and Wilson (2007) specifically examine the effects of rideshare programs on commute trips. Although travel is increasingly non-work-related, Dill and Wilson argue that commute trips still represent a large share of peak travel, particularly in the morning. As such trips are more predictable and regular than non-work (such as shopping, medical, and recreational) trips, they are good candidates for TDM strategies that attempt to shift mode choice from SOV to transit and ridesharing.

Using data from large worksites in the Portland area, Dill and Wilson evaluated the influence of employer TDM programs, work site characteristics, and location on mode choice for work commutes. Multivariate statistical regression techniques showed that land use patterns, transit service access, and public transit subsidy levels all contribute to higher levels of work trips made by transit, bicycling, and walking. Street connectivity (which is typically higher in older neighborhoods and downtown areas) was also associated with lower levels of solo commuting. Land use patterns were particularly significant at sites outside the downtown core. Non-financial employee incentives, such as flex-time and guaranteed ride home programs, also had significant positive effects on ridesharing. While free parking proved to significantly encourage solo commuting, it did not prove to "trump all" other TDM efforts, as some fear.

The Portland study attempted to analyze factors other than TDM that might explain shifts among commute modes, but the data were from employment sites that could not be disaggregated to individuals. While a seemingly arcane issue, this means that the analysis was not able to capture the influence of household demographics, non-commute travel behavior, and household location on commute mode choices.

Such limitations notwithstanding, this study found that many factors unrelated to TDM – like land use patterns and parking availability – significantly affected solo commuting. Further, this relatively carefully executed study considered only the effects of such factors on aggregate commute mode choice, and not on regional traffic or congestion levels. While higher levels of walking, biking, and transit use should be associated with lower levels of traffic generated per employee, the effects on overall traffic levels are more subtle and complex. In particular, the effect of latent demand on regional street and freeway traffic levels is not considered in this study.

Wambalaba et al (2004) used 1997 and 1999 Puget Sound data sets generated as part of an employer commute trip reduction regulation to determine the price elasticity of ridesharing.[4] The model constructed provides predictions of mode choice based on vanpool costs, vanpool subsidies, and work status of the participant. Wambalaba et. al found that a $1.00 increase in vanpool prices is associated with a 2.6 percent decrease in the predicted likelihood of

[4] Price elasticity of demand measures the nature and degree of the relationship between changes in quantity demanded of a good and changes in its price. In this case, the study examined how changes in the price of vanpool services affected their use, evaluating the effectiveness of rideshare programs by estimating the elasticity of demand for vanpool services. The majority of TDM studies on the price elasticity of demand for alternative modes have focused on transit, while most studies of rideshare programs have been qualitative in nature.

choosing to vanpool instead of driving alone. Conversely, a dollar decrease in fare (from either fare reductions or from subsidies) is associated with a 2.6 percent increase in vanpool use. The predicted odds of using a vanpool over driving alone increase by 8.9 percent with the presence of a vanpool subsidy. Additionally, Wambalaba et al found that an employee working in the administrative field is 50 percent more likely to choose a vanpool over driving alone, while an employee in the technical services field is 23 percent more likely to use vanpool than drive alone.

However, this study has two important limitations. First, the model developed was constructed from a local data set such that the findings therefore may be unique to the Puget Sound area and not generalizable to other areas. Second, the study uses data from a single time period, and thus does not allow one to predict changes in behavior over time. While a cash subsidy of vanpools is materially equivalent to a price reduction to users, the behavior effects estimated may be to the change in effective price, and not to the effects of lower, subsidized vanpool prices over time (Wambalaba et al 2004, xi).

## ADMINISTRATION AND MANAGEMENT OF EMPLOYER-BASED TDM PROGRAMS

Ferguson (1990) conducted an evaluation of employer-sponsored ridesharing programs in Southern California. Based on a survey of ridesharing programs, firm size was found to be the most important factor in explaining program effectiveness. Larger firms were most likely to offer direct incentives to their employees, and were somewhat more likely to offer staggered work hours and compressed work weeks. Large firm employees were also more likely to rideshare, controlling for other firm, program, and policy factors. Based on these findings, Ferguson suggests that employer-based ridesharing programs are most cost-effective at larger firms, and that regulatory efforts are required to compel a sufficient number of employers to aggressively implement ridesharing programs to achieve regional-scale effects on travel behavior.

More narrowly, Hendricks (2005) examined the role of employee transportation coordinators (ETCs) and the organizational culture on commute trip reduction in employer-based TDM programs. She found that, while effective and well-trained ETCs can be important contributors to successful TDM programs, other factors, such as proximity to good transit service, employee demographics, and management support TDM programs are equally or more important in determining changes in solo commuting at work sites.

Cleland and Loiselle (2000) conducted an experiment using test and control groups to observe differences in travel modes with and without commute trip information, respectively. They used travel diaries collected on non-work trips to develop suggestions on alternative locations, modes, transit schedules, carpooling, and times of day for travel. The test group was given travel information (alternatives) and then kept travel diaries afterwards. Cleland and Loiselle found that 80 percent of the generated travel suggestions were related to reducing non-work travel (such as recreational or shopping trips). They found also that the group that received customized information reduced their travel by an average of one trip and five miles per day more than the control group that received no suggestions. The findings suggest that the provision of customized information (such as route/schedule planning) and benefits of alternatives to solo-driving (e.g. provision of a rating of "carbon footprint," for example) may lead to decreases in solo driving. Though these services do allow travelers to make efficient decisions (especially using real-time information systems), long-term durability is not known, especially give the effects of triple convergence.

## GUARANTEED RIDE HOME PROGRAMS

Guaranteed ride home (GRH) programs seeks to remove an important deterrent to commuting by alternative modes by guaranteeing employees a ride home if the employee stays late at work or needs to leave early for personal reasons. While these programs have typically been evaluated as part of larger ridesharing program evaluations, Menczer (2005) surveyed and documented the overall costs of guaranteed ride home programs, by examining eligibility requirements, provision of rides (through taxis, agency vehicles, rental cars, or some combination), methods of payment, restrictions on use, cost per claim, and utilization rates of GRH programs. He found that average costs per claim and cost per registered participant were both low, as were usage rates. He further found no statistically significant correlation between program restrictions and program costs, implying that GRH implementation should not be too restrictive in its guidelines for eligibility and claims. Though Menczer asserts that the increasing awareness of GRH programs among employers will encourage employees to "leave their cars at home and use public transportation and other non-SOV modes [such that] transit ridership should increase as will other non-SOV modes of commuting" (p.15), there was no assessment in the study of impact of such programs on SOV travel.

## TELECOMMUTING

Telecommuting programs attempt to reduce congestion by allowing employees to work from home, thereby eliminating the need for commute trips, or by allowing employees to work from a satellite office or telecenter. Perhaps owing to their high-tech connotations, telecommuting programs have been extensively studied over the years (Kitamura, et al. 1990; Mokhtarian, 1990a; 1990b; 1991; Pendyala, et al., 1991). Collectively, these studies have found that, while telecommuting may reduce (or, in the case of satellite offices, reroute) commute trips in private vehicles, they may actually increase private vehicle travel for other trip purposes (such as errands and trips during the course of work). Further, like vanpool programs, fragmentary evidence suggestions that telecommuting may encourage people to live farther from their workplaces than they would otherwise. Belapur (1998), for example, found that workers were more likely to drive to their satellite offices and telecenters, and were also likely to drive home for lunch. Choo et al (2005) found that nationwide, long-term reductions in VMT due to telecommuting were less than one percent.

## TRANSIT AS TDM

Finally, DeCorla-Souza and Gupta (1989) conclude that policies "focusing only on ride-sharing would be less effective… [in affecting solo driving than] a combination transit/ride-share strategy [which] would divert more travelers from single occupancy vehicles (SOV), though transit would capture fewer of these than under a transit-only focused strategy." Accordingly, the next section considers evaluations of transit-focused TDM strategies.

The Wambalaba et al study (2004) drew its methodological inspiration partially from a study of transit fare elasticity, performed by Richard Voith (1991). Voith's study is important because he attempted to measure change in mode choice over time, given policy changes in transit. Voith used rail transit ridership in the Philadelphia area from the Southeastern Pennsylvania Transportation Authority (SEPTA) from 12 separate points in time between 1978 to 1986. The study analyzes how riders responded to changes in transit fare price, service levels (frequency), and alternative options, such as cars. Voith found that transit riders were more than twice as responsive to price changes in the long run as in the short run. In other words, current transit users are less likely to make short-term changes in transit use in response to changes in transit fares or fuel prices, but more likely to shift travel modes in response to price changes over time.

Of notable importance to policy in Voith's and Wambalaba's studies, characteristics of transit service (such as frequency and speed of trains), and the prices of alternative transportation modes (such as vehicle insurance and fuel prices) have significant effects on ridership – substantially larger effects in the long-term than in the short-term. It is possible that in the short term, for example, riders may not stop riding transit immediately in response to a fare increase, but would be more inclined to save for and buy a car in the longer term (Wambalaba et all 2004).

Domencich and Kraft in 1970 implied, and Lee in 1992 explicitly argued, that because the cost of auto travel is relatively low compared to other household expenses, lowering the price of transit will not sufficiently make it an attractive mode. Wambalaba et al (2004) carried the logic forward to argue that improving transit service qualities (like reliability and frequency of service) are therefore likely to be more important than lower fares in attracting motorists to change to transit. Wambalaba et al concede, however, that it remains an enormous challenge for traditional fixed-route public transit to provide "even a near substitute for the qualities of most auto trips" (Wambalaba et al 2004, 9).

Referring to a recent Transit Cooperative Research Program report published by the Transportation Research Board of the National Academies of Science, Engineering, and Medicine on Transit Fare Pricing Strategy in Regional Intermodal Systems, Wambala et al note that travel demand modeling efforts:

> Typically assume shifts of trips lost from one mode (e.g., transit) to other available mode(s), but these are limited in that they typically assume that no trips are foregone altogether. Therefore, the analysis of fare change effects (either projected or after-the-fact) focuses simply on the change in transit trips, without regard to the 'redistribution' of the lost trips. For example, with respect to cross-price elasticity of transit and the automobile, the TCRP Project H-6 synthesis revealed that while numerous studies have shown that increasing the costs of driving has reduced the share of drive alone commuting, the effects on transit use are less clearly understood. The synthesis argued that raising the price of auto travel will lead some motorists to shift to transit, but the greatest effect of a price increase (assuming that the price change is noticeable at all) would likely be in the growth of ridesharing or simply fewer trips. However, it pointed out that since the relative proportions of trips taken by transit versus auto is so lopsided in most areas, small percentage of auto trips lost to transit would mean a much larger percentage of transit trips gained from auto (Wambalaba et al 2004, 10).

Wambalaba et al (2004) note that Kain (1994) has argued persuasively that implementing congestion pricing would make transit and carpooling more attractive. First, according to Kain, solo driving would become relatively more expensive than high-occupancy modes. Second, reducing congestion would improve travel times for these alternative modes, and even rail trips with grade separated rights of way would benefit from improved road access for passengers. Third, both Kain (1994) and Shoup (1994) have shown that that congestion pricing would increase the number of potential carpool matches as increasing numbers of commuters seek alternative modes in response to price changes. Finally, as transit demand increases, transit operators would likely respond by increasing service frequencies and route coverage – thereby increasing both transit service quality and cost-effectiveness in what Small (2006) has termed a "virtuous cycle."

Finally, in a recent study of the factors that influence transit passengers' satisfaction with waiting for and transferring on transit in Los Angeles, Taylor, Iseki, Miller, and Smart (2007) find that users exhibit a "hierarchy of transit user needs." Put simply, people will not use transit unless they feel some minimum level of personal safety. Above some minimum safety threshold, service frequently and reliability are the most important factors affecting ridership. Only after these critical safety and service needs are met, do vehicle and stop amenities (such as restrooms and comfortable seating) meaningfully influence transit satisfaction and use. Given this hierarchy, Taylor et al conclude that many transit systems inappropriately focus on large capital improvements to transit systems, when focusing on improving safety at problematic transit stops, increasing the schedule reliability of service area-wide, and increasing the frequency on already well-patronized lines are likely to be the most cost-effective ways to increase patronage.

## THE HIDDEN INFLUENCE OF "PRICING" IN EFFECTIVE "SOFT" TDM PROGRAMS

Such limitations notwithstanding, the results above highlight the significant effects that changes in the prices paid by travelers can have on travel behavior choices. Likewise, Herzog et al (2005), cited in Dill and Wilson (2007) evaluated worksites in Denver, Houston, San Francisco, and Washington, DC, and found that comprehensive TDM packages of benefits, including financial incentives (such as deep discounts for transit or subsidized vanpool services), improved services, and marketing reduced solo driving by 15 percent. Absent financial incentives, travel reductions are reduced by half. This again suggests that the most significant effects in ostensibly "soft" TDM programs are associated with changes in the relative prices of transportation modes.

In his 1994 review, Kain concluded that free parking at employment sites significantly increases solo commuting. He recommends policies aimed at reducing employer-paid parking, suggesting that parking subsidies may preempt the need for congestion pricing. In contrast, Downs (2004) favors market-based pricing of parking because it is easier to administer, with less threat to individual privacy.

Shoup (2005) has argued that free parking is the most common fringe benefit offered to workers, and the cost of parking subsidy is about one percent of the gross national product. He shows, through case studies and statistical models that free parking (that is, parking that is employer-paid) increases the number of cars driven to work by 33 percent. When employers offer their employees the option to cash out their parking subsidies, however, they reward the use of alternative modes and effectively charge drivers who do not cash out.

## Recent Research on Soft TDM Strategies: What is Realistic to Expect in Southern California?

So what can we learn from the research on TDM, and what are the implications for using TDM to reduce traffic congestion in Southern California? We can draw the following general conclusions regarding the possible effects of soft TDM strategies on travel:

- The soft TDM strategies that overlap with TSM strategies have considerable promise to cost-effectively increase the effective capacity of existing street and highway systems. Such increases in effective capacity can bring substantial social and economic benefits, but are likely to have mostly localized effects on congestion delay at best.
- Soft TDM strategies implemented at large employment sites by employers can have substantial intersection-level effects on congestion, but the benefits are likely to fade unless the employer is highly motivated (by, for example, a trip cap) to actively maintain the program. The effects of such programs on regional congestion levels are likely negligible.
- The benefits of substantially increasing expenditures on TDM strategies at the regional level are not well-supported by the TDM program evaluation literature. This does not mean that such expenditures might not be justified, only that the scope and quality of the current literature cannot currently serve as evidence in support of increased investment.
- Soft TDM strategies are popular because they are voluntary and have limited effect on travel behavior. Likewise, hard TDM, are widely viewed as politically risky because they significantly affect travel behavior. Accordingly, soft TDM policies have often been promulgated because they raise so few objections, and have often failed to meet expectations because they are voluntary and have limited effect on travel behavior.
- Soft TDM strategies may be most useful in relieving congestion in the short-term while hard TDM programs are being gradually implemented. Soft TDM programs may also act soften the political resistance to pricing-based or regulatory strategies, by mainstreaming the idea of managing travel demand.
- While soft TDM programs implemented by a motivated employer have repeatedly proven effective at increasing employee travel by alternative modes, the potential for such programs to affect (1) commute trips to small or scattered employment sites, (2) non-commute trip purposes (that constitute more than 80% of metropolitan person trips), or (3) regional scale congestion is likely low and should not be oversold – though it often is.

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